United States Patent [19]

Dupuis

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[54] **REMOVAL OF CONNECTOR PINS**

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[51] **Int. Cl.²** **H05K 3/00**

[58] **Field of Search** ..... 29/203 B, 203 H, 203 HM, 29/427, 426, 243.52, 243.53, 243.54, 509; 72/391; 225/103, 93 R; 228/264

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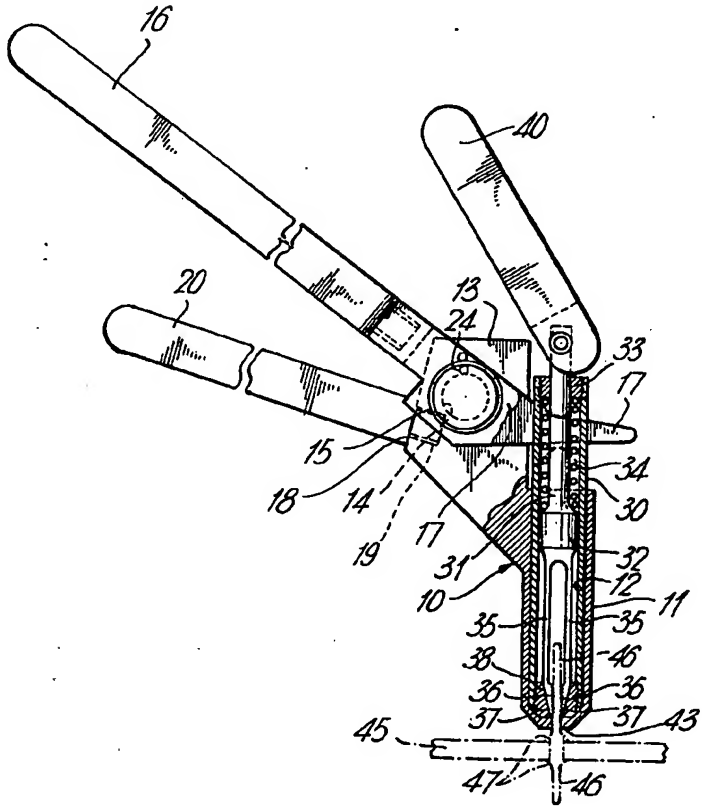
[57] **ABSTRACT**

The removal of connector pins from a panel, such as a printed circuit board, in which the pin extends from the panel and is soldered to a circuit member on one or both sides of the panel, is achieved by a tool positioned over the pin and having a main body member which is held in contact with the panel surface and with an axially sliding gripping member having a split gripping portion. The gripping member is moved by a tubular member surrounding the gripping member and which, on axial movement, forces the split gripping portion of the gripping member into firm frictional contact with the pin, further axial movement of the tubular member moving the gripping member and pin axially shearing the solder joint. The tubular member is moved by a pivotally mounted handle, the reaction from the pivoting of the handle and pulling on the pin holding the tool firmly against the panel. The pin is removed without damage to the panel and a new pin can be inserted and resoldered using the remaining solder at the joint.

2 Claims, 4 Drawing Figures



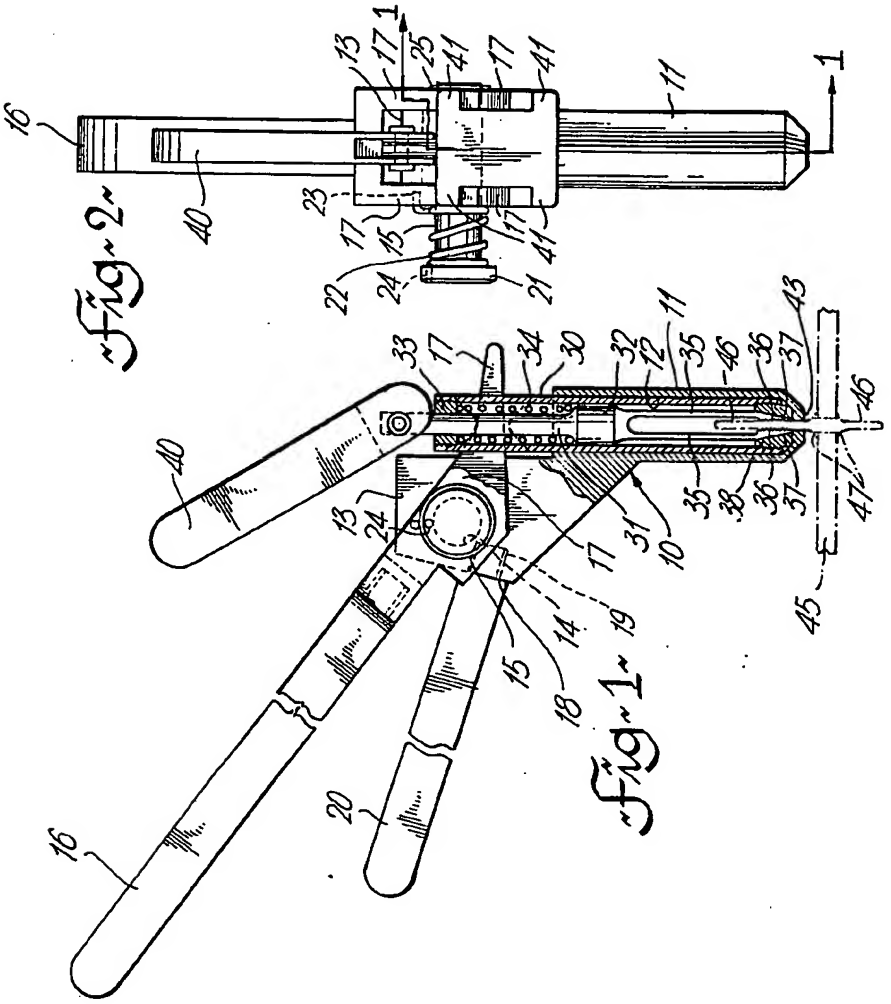


Fig. 1

Fig. 2

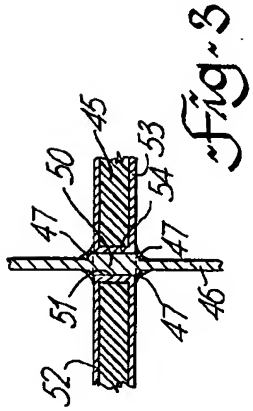


Fig. 3

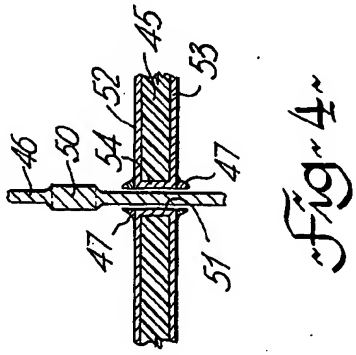


Fig. 4

REMOVAL OF CONNECTOR PINS

This invention relates to the removal of connector pins from panels, circuit boards, connector blocks and similar articles.

In many wiring positions, particularly in panels in telecommunications systems and similar systems, conductors are connected to pins which enter, or pass through a panel or other member. Often large numbers of such pins are provided at quite small centre to centre spacing. A pin may pass right through a panel or board, with conductors attached at both ends. Typically pins may be of a square cross-section for connection of conductors by wire wrapping.

Whatever the form of pin, it occurs that a pin is damaged. The damage can occur during manufacture or during connection or reconnection. It is then desirable that the pin be replaced. Such replacement must be done without damage to the board. Usually a pin may be in contact with a circuit part, for example a printed circuit, being soldered to the circuit. The soldered contact must be broken without damage.

Conventionally, to remove a damaged pin, it is cut off as close as possible to the surface of the panel or board. A hole is then drilled in the pin as close as possible to the centre. Heat is then applied, with a soldering iron, to remove the remainder of the pin. A new pin is inserted and solder applied, one side or both sides, hopefully making contact with the previous area around the original pin. Often the hole in the board or panel is damaged. In laminated materials, delamination can occur. Where plated through holes are provided for the pins, and plating is removed from the hole when the old pin is removed. Thus the replacement of a pin is difficult and not always resulting in the efficient replacement.

The present invention provides for the removal of pins by a tool which grips the pin and then pulls on the pin while pushing against the panel or board. Soldered connections between pin and board are sheared and most of the solder, and plating in the holes where holes are plated through, remains intact and this assists in the emplacement of a new pin.

As a particular example of the present invention, apparatus for removing a pin extending from a panel and soldered to at least one surface thereof, comprises a main body member including a hollow bottom portion and an offset top portion, the bottom portion including an inwardly extending annular flange having a bottom face for positioning against the panel; a fixed handle attached to the top portion of the body member and extending laterally therefrom; a moveable handle pivotally mounted on the top portion, moveable about a pivot extending normal to the axis of the fixed handle, the moveable handle including a main portion on one side of the pivot and overlying the fixed handle, and also including an extension on the other side of the pivot; a tubular member mounted in the hollow bottom portion of the body member for axial movement therein, the tubular member including a tapered bore at a lower end extending downwardly and inwardly, and at least one protrusion at an upper end in engagement with the extension on the moveable handle, the lower end of the tubular member resting against the annular flange of the bottom portion of the body member; a gripping member mounted in the tubular member for axial movement therein and including upper and lower parts, the lower part hollow and split, to receive a pin, and including a tapered external surface at the extremity of the lower part adapted to cooperate with the tapered bore at the lower end of the tubular member, the arrangement such that pivoting of the moveable handle to move the main portion toward the fixed handle, moves the extension in a direction away from the bottom portion of the body member, the extension in engagement with the protrusion to move the tubular member axially, initial movement of the tubular member forcing the extremity of the gripping member into engagement with a pin, further movement pulling the tubular member, gripping member and pin from the panel, shearing the solder joint, reaction on the body member holding the bottom face in contact with the panel.

The invention will be readily understood by the following description of one form of tool, in conjunction with the accompanying drawings, in which:

FIG. 1 is a side view of a tool, partly in section as on the line I—I of FIG. 2;

FIG. 2 is a front view of the tool of FIG. 1;

FIGS. 3 and 4 are cross sections illustrating a pin in a board, and removed from a board respectively.

The tool comprises a main body member **10** having a bottom portion **11** of square cross section, and having a bore **12** therethrough. The top portion **13** is offset from the axis of the bottom portion **11** and has a transverse bore **14** therethrough. The bore **14** accepts a pivot pin **15** on which is pivotally mounted a moveable handle **16** having two spaced apart limbs or extensions **17**. The extensions **17** are spaced apart to straddle the top portion **13** of the body member **10** and have transverse bores through which passes the pivot pin **15**. In the rear face **18** of the top portion **13** is a threaded bore **19** into which screws the end of a fixed handle **20**.

The pivot pin **15** extends from one side of the tool, as seen in FIG. 2, and has an enlarged head **21**. A tension spring **22** is wrapped round the pin extension, one end of the spring held in a hole **23** in one of the extensions **17**, and the other end of the spring held in a hole **24** in the enlarged head **21**. At the end remote from the enlarged head **21**, the pin is grooved circumferentially to receive a lock ring **25**. A screw (not shown) in the top portion engages with the pivot pin to prevent rotation. The lower end of the bottom portion **13** has an inwardly extending annular flange **26** forming a bore **27**. The bore **27** is a fairly close fit around the pin to be removed.

Positioned in the bore **12** in the bottom portion **11** of the body member **10** is a tubular member **30**. Positioned in the bore of the tubular member **30** is a pin gripping member **31**. Gripping member **31** has a central part **32** which is a sliding fit in the bore of the tubular member **30**. Above the central part **32**, the gripping member **31** is of reduced diameter and passes through a bush **33** threaded into the top end of the tubular member **30**. A compression spring **34** surrounds the upper part of the gripping member and abuts against the bush **33** and the central part **32**.

Below the central part **32**, the gripping member is bifurcated to form two members **35**. At its lower extremity the inner surfaces **36** of the two members **35** are serrated. The outer surfaces **37** of the members **35** are tapered downwardly and inwardly and fit into a tapered bore at the lower end of the tubular member, the bore conveniently formed in a bush **38** screwed into the lower end of the tubular member **30**.

The upper end of the gripping member 31 extends up out of the tubular member 30 and carries a cam level 40. The cam lever 40 bears against the top surface of the tubular member 30 and can lift the gripping member 31 against the action of the spring 34.

The upper end of the tubular member 30 is enlarged, having two protrusions 41, one on each sde. Slots cut in the protrusions 41 accept the ends of the two extensions 17 of the moveable handle 16.

The tool is used as follows. The tool is positioned over a pin, the pin extending through the bore 27 in the body member 10 and up between the members 35 of the gripping member 31. The lower end 43 of the body member is pushed down until it contacts the board, or more precisely, the solder fillet around the pin. This is indicated in FIG. 1, the board 45 and pin 46, with solder fillets 47, shown in dotted outline. The two handles 16 and 20 are then squeezed together by the pivoting of moveable handle 16. As handle 16 pivots, the extensions 17 pull upward on the protrusions 41. This pulls the tubular member 30 upward and the tapered surfaces of the bush 38 acting on the tapered surfaces 37 of the members 35 of the gripping member 31 forces the serrated surfaces 36 into gripping engagement with the pin 46. Continued movement of the handle 16 pulls on the pin, the reaction pushing the lower end 43 of the body member against the solder fillet 47. This opposed pulling and pushing, with the close fit of the bore 27 around the pin 45 causes the solder joint around the pin to shear and the pin is pulled out cleanly, without damaging the board, leaving most of the original solder in place, and where plated through holes are used, does not damage the plating in the hole.

The members 35 are finally retracted by the lever 40. This lifts the gripping member 31 up disengaging the tapered surfaces of the members 35 and the bush 38. The pin is then pulled out of the tool. Release of the lever 40 allows the gripping member to return to its initial position. The clearance between the serrated surfaces 36 is such that there is initial friction between the serrations and the pin on initial positioning of the tool over a pin.

FIGS. 3 and 4 illustrate a pin in a printed circuit board, and removed from the board respectively. The pin is swaged at an intermediate position 50 to provide a fairly tight fit in the hole 51. The particular board shown has printed circuits 52 and 53 on each side, and the holes 51 are plated through at 54.

A new pin is easily inserted, with a conventional insertion tool, and heat applied to the pin will melt the solder 47 and remake a satisfactory connection. The tool is of a size which permits removal of pins in a closely spaced board or panel. The panel or board is not heated at all for pin removal, and only slightly on pin insertion.

While the pins 46, in the present example, are of square cross-section, round pins can also be extracted. For round pins, the lower end of the gripping member 31 would have a threaded hole formed, prior to slitting for example, the threads then acting as serrations.

I claim:

1. Apparatus for removing a pin extending from a panel and soldered to at least one surface thereof, comprising:

a main body member including a hollow bottom portion and an offset top portion, said bottom portion including an inwardly extending annular flange having a bottom face for positioning against said panel;

a fixed handle attached to said top portion and extending laterally therefrom;

a moveable handle pivotally mounted on said top portion, moveable about a pivot extending normal to the axis of said fixed handle, said moveable handle including a main portion on one side of said pivot and overlying said fixed handle and also including an extension on the other side of said pivot;

a tubular member mounted in said hollow bottom portion for axial movement therein, said tubular member including a tapered bore at a lower end, said tapered bore extending downwardly and inwardly, and at least one protrusion at an upper end, said protrusion in engagement with said extension on said moveable handle, the lower end of said tubular member resting against said annular flange of said bottom portion of said body member;

a gripping member mounted in said tubular member for axial movement therein, said gripping member comprising a central part a close sliding fit in said tubular member for guidance of said gripping member, a lower part of hollow form and split longitudinally to form two opposed gripping surfaces, and an upper part of reduced diameter and extending up through the upper end of said tubular member beyond said extension on said moveable hand and said protrusion on said tubular member, said central part forming a lower abutment for a spring;

an abutment at the upper end of said tubular member and a compression spring extending between said abutments; and

a cam lever pivotally mounted on the upper end of said upper part of said gripping member, said cam lever pivotal about an axis normal to the longitudinal axis of said gripping member, said cam lever engaging with the upper end of said tubular member, pivotal movement of said cam lever lifting said gripping member axially relative to said tubular member to open said lower part of said gripping member and retains said pin;

the arrangement such that pivoting of said moveable handle to move said main portion toward said fixed handle, moves said extension in a direction away from said bottom portion of said body member, said extension in engagement with said protrusion to move said tubular member axially, initial movement of said tubular member forcing said extremity of said gripping member into engagement with a pin within said gripping member, further movement pulling said tubular member, gripping member and pin from said panel, shearing the solder joint, reaction on said body member holding said bottom face in contact with said panel.

2. Apparatus as claimed in claim 1, said split hollow lower part of said gripping member having serrated opposed surfaces for gripping the pin.

* * * * *

June 29, 1971 R. C. HOY 3,588,983

EXTRACTOR TOOL

Filed March 10, 1969

Fig. 1.

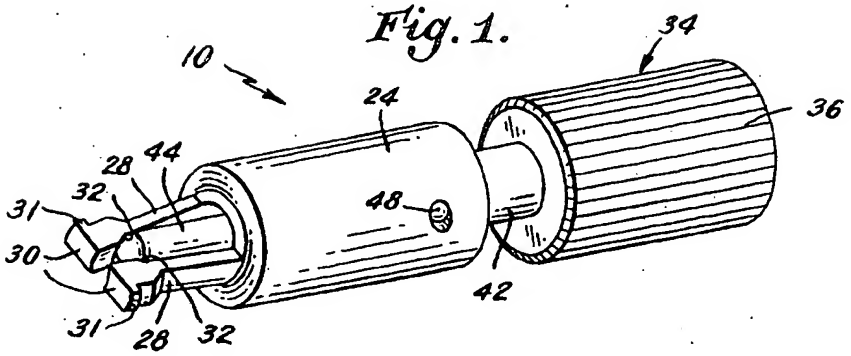


Fig. 2.

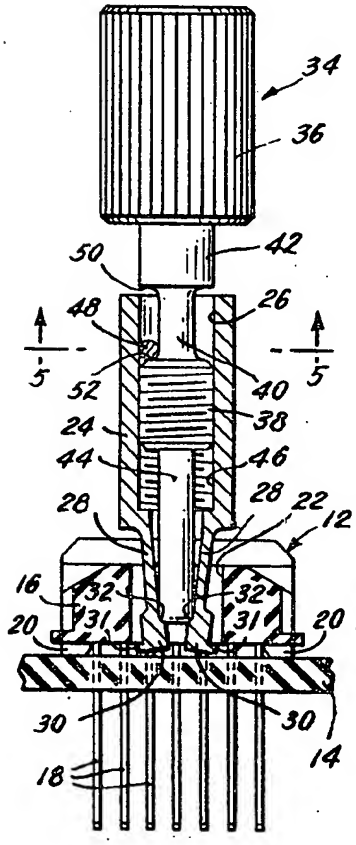


Fig. 3.

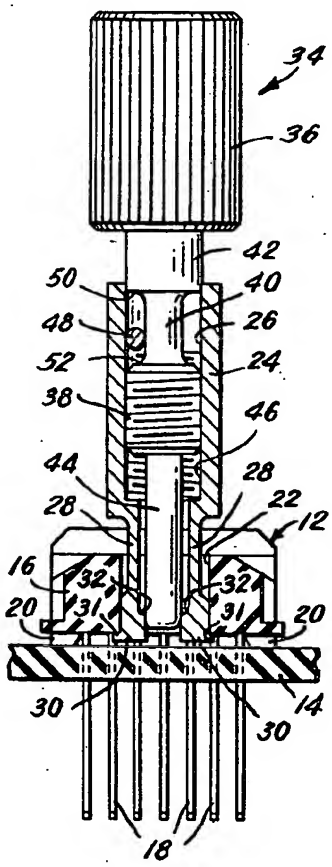
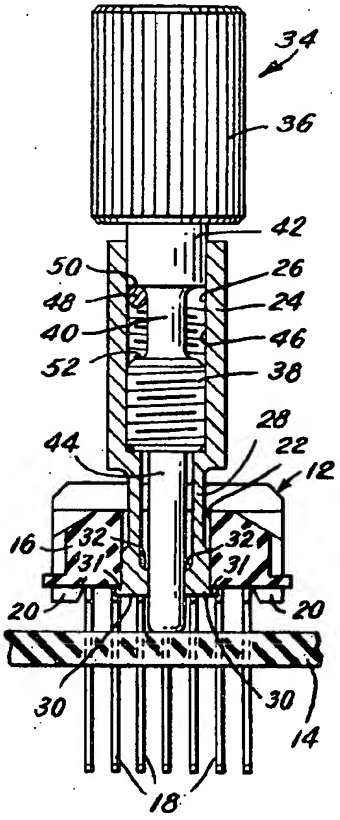


Fig. 4.



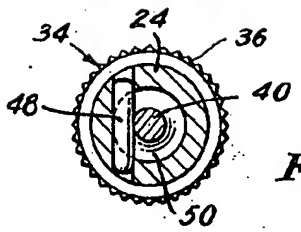


Fig. 5.

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3,588,983

EXTRACTOR TOOL

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Filed Mar. 10, 1969, Ser. No. 805,399
Int. Cl. B25b 27/02
U.S. Cl. 29—203 7 Claims

ABSTRACT OF THE DISCLOSURE

A tool for extracting an electrical contact insulator assembly from engagement with a panel board and including a barrel having spaced legs through which an actuating member projects, the actuating member urging the legs into contact with the insulator assembly and the insulator assembly thereafter being moved with respect to the panel board upon rotation of the actuating shaft.

BACKGROUND OF THE INVENTION

The extractor tool as embodied in the present invention has particular application in removing an electrical contact insulator assembly from a panel board, the insulator assembly being of that type illustrated and described in copending application Ser. No. 748,537 filed July 29, 1968.

In the contact insulator assembly illustrated in the above-referred to copending application, a plurality of contacts are mounted in the non-metallic housing of the assembly and in the use thereof, the contacts project through openings formed in a panel board. On occasion, the contacts as they project through the panel board become damaged and the entire insulator assembly must then be removed from the panel board for replacement of the damaged contacts. Heretofore, extracting an insulator assembly from a panel board was difficult to accomplish since the contacts of the insulator assembly were firmly embedded in the openings formed in the panel board; and when efforts were made heretofore to remove the insulator assembly for replacing a damaged contact, by pulling outwardly on the assembly, the assembly was either chipped or additional contacts were bent or broken during the extraction procedure.

SUMMARY OF THE INVENTION

The present invention relates to a tool for use in extracting an electrical contact insulator assembly from engagement with a panel board, and includes a barrel having spaced legs joined to an end thereof. The legs have resilient characteristics that provide for outward lateral movement with respect to each other, and an actuating member extends through the barrel and engages the interior of the barrel in threaded relation, wherein the actuating member is longitudinally movable with respect to the barrel. The legs are inserted through a central opening in the insulator assembly and upon longitudinal movement of the actuating member, an end of the actuating member rides over cam surfaces of the legs and urges the legs laterally outwardly and into locking engagement with the contact insulator assembly. Thus upon continued movement of the actuating member with respect to the barrel, the end of the member contacts the panel board and forces the contact insulator assembly away from its locked position on the panel board.

Accordingly, it is an object of the present invention to provide an extractor tool for lifting an electrical contact insulator assembly from engagement with a panel board so as to expose the contacts of the insulator assembly.

Another object of the invention is to provide an extractor tool for removing a contact insulator assembly from a panel board that includes a barrel through which an actuating member extends for movement with respect thereto, relative movement of the actuating member with respect to the barrel providing for disengagement of the contact insulator assembly from the panel board on which it is mounted.

Still another object is to provide an extractor tool having a barrel through which an actuating member extends, the barrel being formed with spaced legs having feet formed thereon, and the actuating member including a reduced end that is adapted to engage the legs for forcing the feet laterally outwardly for engagement with an element to be extracted.

Other objects, features and advantages of the invention will become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the extractor tool embodied in the present invention;

FIG. 2 is a vertical sectional veiw of the extractor tool, showing the position thereof when it is first inserted into a contact insulator assembly for removal of the assembly from a panel board;

FIG. 3 is a sectional view similar to FIG. 2 showing the actuating member of the tool in the position thereof as it urges the legs of the tool into engagement with the insulator assembly;

FIG. 4 is a sectional view similar to FIGS. 2 and 3 and illustrating the position of the actuating member of the tool as the insulator assembly is withdrawn from its mounted position on a panel board; and

FIG. 5 is a sectional view taken along line 5—5 in FIG. 2.

DESCRIPTION OF THE INVENTION

Referring now to the drawing, the extractor tool embodied in the present invention is generally indicated at **10**, and in its intended use, the extractor tool **10** is adapted to extract a contact insulator assembly generally indicated at **12** from a panel board **14**. As illustrated and described in copending application Ser. No. 748,537, the contact insulator assembly **12** is defined by a housing **16** formed of non-metallic insulating material and having a plurality of openings formed therein through which a plurality of contact members **18** extend. Each of the contact members **18** is formed with a transverse hilt **20** that spaces the bottom of the housing **16** from the panel board **14** when the insulator assembly **12** is in its mounted position on the panel board. As will be described, this spacing between the bottom of the housing **16** and the panel board **14** enables the extractor tool **10** to free the insulator assembly **12** from its locked position on the panel board **14**. Formed centrally in the housing **16** of the insulator assembly **12** is an opening **22** that extends through the housing **16** and has a substantially rectangular configuration when seen in top plan view.

Referring again to FIG. 1, and as further illustrated in FIGS. 2 through 5, the extractor tool **10** includes a barrel

or body portion 24 having an opening or bore 26 formed therein. Joined integrally to the barrel 24 at an end thereof are spaced legs 28 that are formed with feet 30 on the outermost ends thereof. Joined to the feet 30 and projecting laterally with respect thereto are toe portions 31, the purpose of which will be described hereinafter. Formed on the interior surfaces of the legs 28 at the junction of the legs with the feet 30 are inclined surfaces 32 that define camming surfaces, the purpose of which will also be described hereinafter.

Projecting through the bore 26 formed in the barrel 24 is an actuating member generally indicated at 34 that includes an enlarged outer gripping portion 36, and an inner shaft portion that is defined by an intermediate threaded portion 38, a reduced intermediate portion 40, a portion 42 that joins the reduced portion to the gripping portion 36, and an actuating shaft portion 44 that is joined to the intermediate threaded portion 38. A portion of the bore 26 is threaded as indicated at 46, and receives the threaded portion 38 of the actuating member 34 in threaded relation therein. The actuating shaft portion 44 of the actuating member 34 projects through the outer end of the bore 26 and between the legs 28 that are joined to the barrel 24. It is seen that the diameter of the shaft portion 44 is dimensioned so as to be received between the legs 28, and the outermost end of the shaft portion 44 is rounded for being received on the cam surfaces 32 of the feet 30. In order to limit movement of the actuating member 34, a pin 48 extends through holes formed in the barrel 24, but is so located that it is offset with respect to the longitudinal axis of the bore, and thereby is received in an annular chamber defined by the reduced intermediate portion 40 of the actuating member and the bore 26.

It is seen that the reduced intermediate portion 40 of the actuating member cooperates with the portion 42 and the threaded portion 38 to define spaced shoulders 50 and 52, the spaced shoulders 50 and 52 forming limits for movement of the actuating member 34. Thus inward movement of the actuating member 34 with respect to the barrel 24 is limited by engagement of the shoulder 50 with the pin 48. Return movement of the actuating member 34 to its outer position is limited by engagement of the pin 48 with the shoulder 52.

With the contact insulator assembly 12 mounted in place on the panel board 14 and with the contact members 18 extending through the holes in the panel board 14, it may be required to withdraw the assembly 12 from its mounted position in order to replace one or more of the contact members. As illustrated in FIG. 2, the legs 28 of the extractor tool 10 are somewhat inclined toward each other, thereby reducing the overall lateral dimension of the legs. In this position of the legs 28, the actuating member 34 is located in its withdrawn position, the shaft portion 44 being located so that the end thereof merely engages the camming surfaces 32 of the feet 30. In order to extract the contact insulator assembly 12, the legs 28 are inserted into the opening 22 of the insulator assembly. As previously described, the hilts 20 of the contact members 18 space the bottom edge of the insulator assembly from the top surface of the panel board 14. When the legs 28 of the extractor tool are fully inserted into the hole 22 of the insulator assembly, the outwardly extending toe portions 31 of the feet 30 are located so as to be insertable into the space formed between the lower surface of the assembly housing 16 and the panel board 14. With the legs 28 fully inserted into the hole 22 the gripping portion 36 of the actuating member 34 is rotated, thereby forcing the shaft portion 44 toward the panel board 14 and separating the feet 30 in the manner as illustrated in FIG. 3. The outwardly projecting toe portions 31 of the feet 30 are then forced into the space between the lower surface of the housing 16 and the panel board 14, thereby locking the feet 30 to the insulator assembly. As the actuating shaft 44 is moved downwardly upon continued rotation of the gripping portion 36, the outer end of the actuating shaft engages the panel board 14 and as rotation of the actuating member is continued, the barrel 24, together with the legs 28 are reversely moved relative to the actuating member 34 thereby withdrawing the insulator assembly 12 therewith. When the actuating member 34 reaches the limit of movement as determined by engagement of the shoulder 50 with the pin 48, the contact members 18 have been lifted sufficiently from the panel board, as illustrated in FIG. 4 to then enable the extractor tool 10 to be withdrawn from the assembly. After the extractor tool is withdrawn, the insulator assembly can be removed by hand from the panel board by pulling upwardly thereon. After the extractor tool has been removed from the insulator assembly, the actuating member 34 is rotated in the opposite direction to retract the actuating shaft portion 44 from between the feet 30. The limit of movement in this direction is defined by engagement of the shoulder 52 with the pin 48 as illustrated in FIG. 2. The extractor tool 10 is then ready for the next extracting operation.

What is claimed is:

1. In a tool for extracting an electrical contact insulator assembly from engagement with a panel board, a barrel having spaced legs joined to an end thereof, said legs having resilient characteristics that provide for outward lateral movement with respect to each other, and an actuating member extending through said barrel and engaging the interior of the barrel in threaded relation, wherein said member is longitudinally movable with respect to said barrel, an end of shaft being engageable with said legs upon longitudinal movement for urging said legs laterally outwardly and into locking engagement with said contact insulator assembly, whereby continued movement of said member into contact with said panel board forces said contact insulator assembly out of its engaging position on said panel board.

2. In a tool as set forth in claim 1, said legs having lateral projecting portions formed thereon that are forced into engagement with said contact insulator assembly upon inward longitudinal movement of said actuating member, wherein said legs force said contact insulator assembly away from said panel board as said member is moved longitudinally inwardly with respect to said barrel.

3. In a tool as set forth in claim 2, said actuating member including a reduced portion that defines spaced shoulders, between which an annular chamber is formed in said barrel and means fixed in said barrel and being received in said chamber and being engageable by said shoulders upon longitudinal movement of said member, whereby said shoulders define the limits of longitudinal movement of said member.

4. In a tool as set forth in claim 3, said means fixed in said barrel including a pin that extends through said chamber transversely of the longitudinal axis of said barrel and being laterally offset with respect thereto, wherein longitudinal movement of said member is limited by the length of said chamber in which said pin is received.

5. In a tool as set forth in claim 1, said legs being normally inclined inwardly and including laterally projecting toe portions on the outermost ends thereof, cam surfaces formed on the inside edges of said legs and being engageable by said shaft upon the inward longitudinal movement thereof, wherein said member urges said legs outwardly to force said toe portions into locking engagement with said contact insulator assembly.

6. In a tool as set forth in claim 5, said actuating member including an enlarged outer portion that defines a gripping portion for rotating the member, an intermediate portion, an area of which is threaded for threadably engaging the interior of said barrel and a reduced inner end portion that extends between said legs, the innermost end of said inner end portion engaging said cam surfaces.

7. In a tool as set forth in claim 6, said intermediate portion including a reduced portion that defines spaced shoulders between which an annular chamber is formed in said barrel, and a pin extending through said chamber transversely of the longitudinal axis of said barrel and being laterally offset with respect thereto, said pin being engageable by said shoulders upon longitudinal movement of said member, wherein said shoulders define the limits of longitudinal movement of said member.

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